SERVOCARD®

Defibrillator SCP 851
SCP 852

Operation Manual

HELLIGE

SERVOCARD® is a trademark of HELLIGE GMBH registered in Canada, France, and in the USA.

- This manual is an integral part of the instrument and describes its normal use; it should always be kept close to the equipment. Observance of the manual is a prerequisite for proper instrument performance and correct operation and ensures patient and operator safety depending on these factors.

- The symbol ⚠ denotes: **Observe the operation instructions!** It serves as an indication of important facts to be noted when operating the instrument.

- Information which refers only to certain versions of the instrument is accompanied by the catalog number(s) of the instrument(s) concerned. The catalog number is given on the instrument nameplate.

- The instrument is not designed for operation in oxygen-enriched atmospheres and/or in zones of risk where explosion hazards may exist.

- The protective measures of class I are only effective, if such instruments are connected to power outlet sockets with protective earth contactors.

- Cables and plugs which are damaged must be replaced immediately. Extension cords, in particular those with multiple connectors, should not be used.

- Instruments into which liquids have penetrated must be immediately cleaned and checked by a service technician.

- Patient safety, maintenance of the specified measuring accuracy, and interference-free operation can only be guaranteed when the patient cables, electrodes, transducers, and probes described in this manual are used.

- Chemicals required for the application or maintenance of the instrument must under all circumstances be stored, prepared, and kept at hand in the containers provided by the manufacturer. Failure to observe this instruction may result in severe consequences for the patient.

- For cleaning and disinfection, line-power operated instruments must be separated from the power line.

- HELLIGE considers itself responsible for the effects on safety, reliability, and performance of the equipment, only
  - if assembly operations, extensions, readjustments, modifications, or repairs are carried out by HELLIGE or by persons authorized by HELLIGE
  - if the electrical installation of the relevant room complies with the applicable national and local requirements and
  - if the instrument is used in accordance with the instructions for use.

  The address of the nearest HELLIGE sales-service office can be taken from the attached address list.

- For detailed information on safety, please refer to the enclosed sheet entitled *Safety*.

- All publications are in conformity with the instrument specifications and IEC publications on safety of electromedical equipment valid at printing date. All rights are reserved for instruments, circuits, techniques, and names appearing in the manual.

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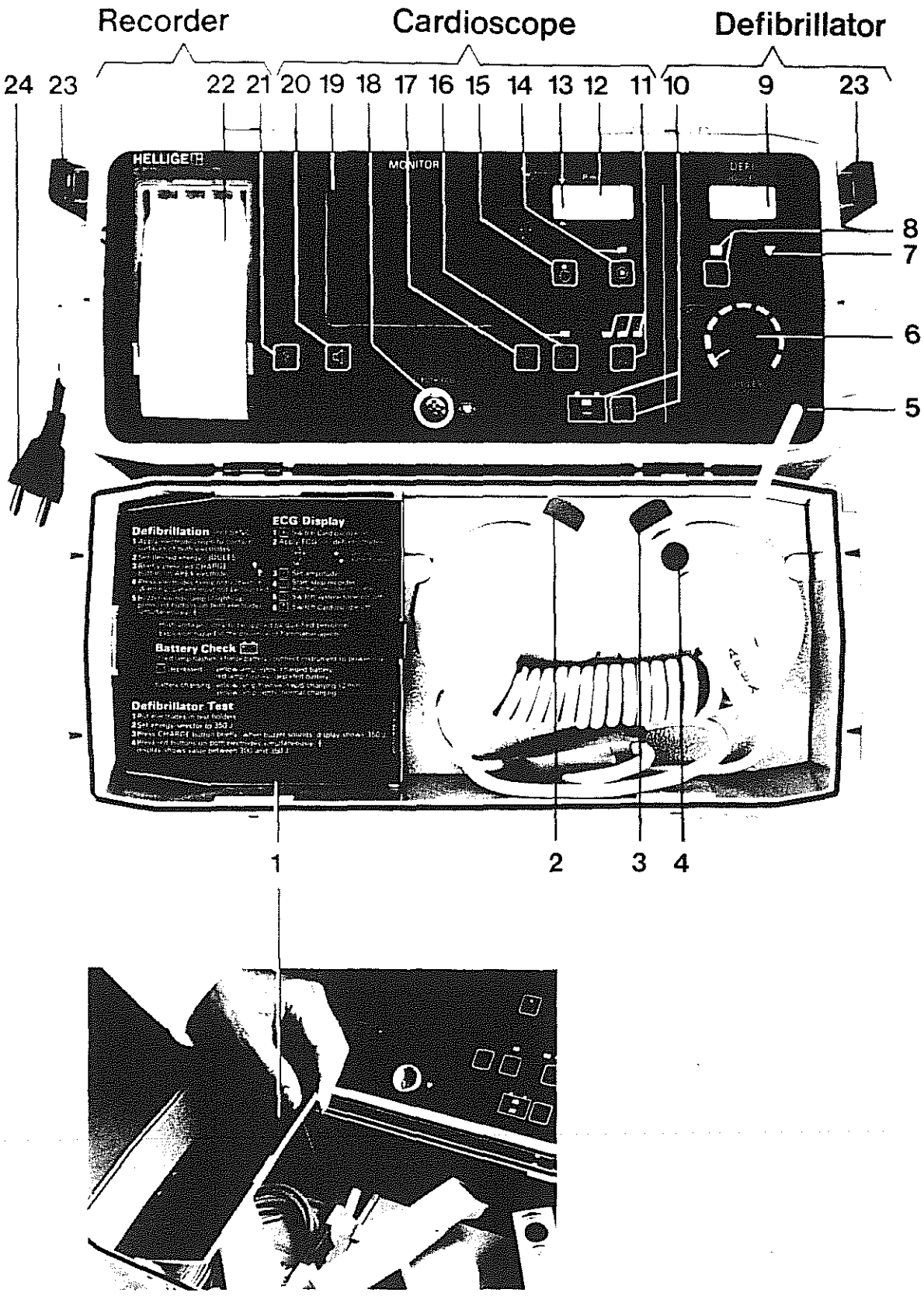
Recorder
Cardioscope
Defibrillator
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 23
8
7
6
5
1 2 3 4
HELLIGE
MONITOR
Defibrillation
ECG Display
Battery Check
Defibrillator Test

Figure 1

(1) Accessory-compartment lid with short-form instructions

(2) Defibrillator electrode with release button

(3) APEX defibrillator electrode with start/release button

(4) Button to start recorder

(5) Cable for defibrillator electrodes*

(6) Energy selector switch

(7) Standby lamp for energy release

(8) Button to switch SYNchronized defibrillation mode on and off, with pilot lamp (only possible while ECG electrodes applied)

(9 Digital display of defibrillation energy

(10) Button for battery test and high-voltage check with battery-control lamps

(11) Button to set ECG sensitivity for cardioscope and recorder

(12) Digital display of heart rate

(13) Indication of ECG-pickup mode

(14) Button to switch cardioscope on and lamp for systole check

(15) Button to switch cardioscope off

(16) STOP button to freeze and release ECG display on cardioscope: lamp lights up when ECG waveform is frozen

(17) 1-mV calibration button

(18) Socket to connect patient cable*

(19) Screen

(20) Button to switch systole sound on and off

(21) Button to switch ECG recorder on and off

(22) ECG recorder

(23) Latches for case lid

(24) Power cord (removable)

* For explanation of symbols, see **Safety** sheet in Appendix.

1 Theory of Operation

The HELLIGE SERVOCARD® Defibrillator SCP 851/852 is a portable, battery-powered cardiac-therapy instrument with a power-line connection for the built-in battery charging device. It is primarily intended for emergency application, but also suited for clinical treatment of certain disordered actions of the heart (DAH). For this purpose, the instrument can be switched to cardioversion (i.e. synchronized "defibrillation"). The energy, released into an external resistance of 50 Ω (electrode-to-skin contact resistance + patient resistance), can be preselected in progressive steps from 0 to 50 Joules (Ws). When the storage process is terminated (capacitor charged), an audiovisual signal indicates readiness for defibrillation-pulse release. The energy to be released is indicated digitally; the amount of energy actually delivered into the patient can be read off after defibrillation. For reasons of safety, both electrode handles habe a pushbutton. Both buttons must be pressed simultaneously to trigger the current rush (two-hand safety operation).

The current-discharge curve corresponds approximately to a sinusoidal halfwave with aperiodic decay. Figure 2 shows the discharge curves for several external resistances.

An integrated cardioscope enables an ECG display. The ECG signal can be picked up either via the defibrillator electrodes from the thorax or by means of limb electrodes. The ECG waveform, displayed on the cardioscope, can be frozen for better scrutiny. Every systole generates a control sound which can be switched off.

A practical testing device allows battery and discharge-circuit control. The built-in battery charger enables quick charging so that an instrument with a depleted battery can be ready for use in a few minutes.

The SCP 852 version has an incorporated ECG recorder which not only records the ECG waveform, but prints out the time the Defibrillator is running, the heart rate, defibrillation energy, and defibrillation current, as well as an indication for patient resistance + contact resistance $> 120\ \Omega$.

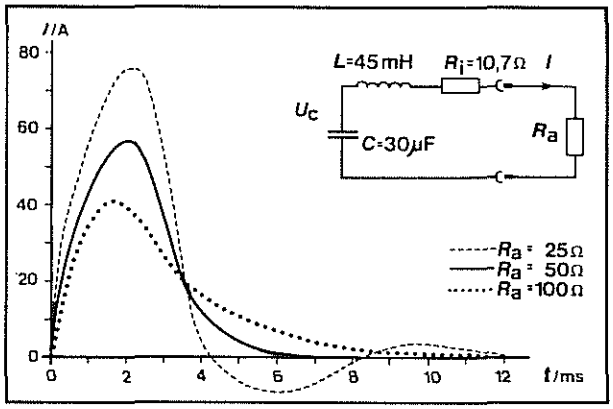

Figure 2

2 Operating Instructions

2.1 Installation

- Observe safety and operating instructions on Safety sheet in Appendix
- Instruments which are inteded for emergency application should not be exposed to low temperatures during storage and transport to avoid misting at the installation site. Otherwise, the operator must wait until the moisture has vaporized
- Instrument is in protection class II
- Release latches (**23**) and open higed lid
- Place instrument so that operator can easily see operating panel
- Carry out performance check (see Section 2.2)

2.2 Performance Check

For reasons of safety, a performance check should be carried out about once a month.

Battery Check

- Disconnect power cord from wall outlet
- Using key (**14**), switch cardioscope on: pilot lamp lights up
- Press key (**10**): if yellow pilot lamp lights up, state of charge is sufficient; if red pilot lamp flashes, battery requires charging (see Section 2.9). Defibrillation cannot be carried out, if there is no battery or if battery is depleted

  Performance-check routine is terminated as soon as key is released or automatically after 4 s, if key is kept depressed. During this routine, high-voltage generator and internal discharge circuit are also checked (low whistling sound).

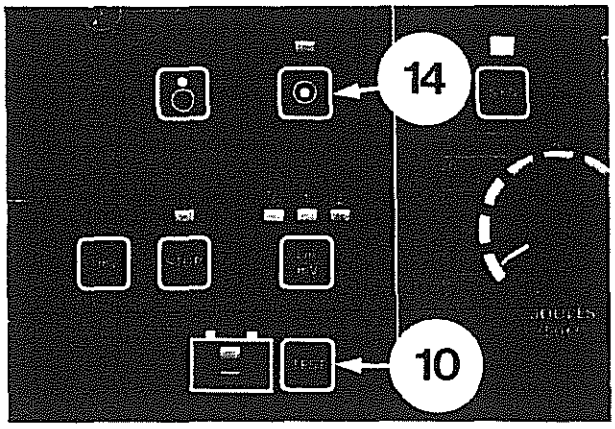

Figure 3

Note:

Have battery replaced by qualified service personnel every 3 years!

Electrode Check

- Visually check defibrillator electrodes and electrode cables for damage to insulation (patient and operator safety)

Discharge-Circuit Check

- Insert defibrillator electrodes into recesses in lid so that protrusions of clamping device fit into corresponding indentations on electrodes
- Press electrodes vigorously into recesses until they click into place to ensure good contact to testing device (APEX electrode on right side)

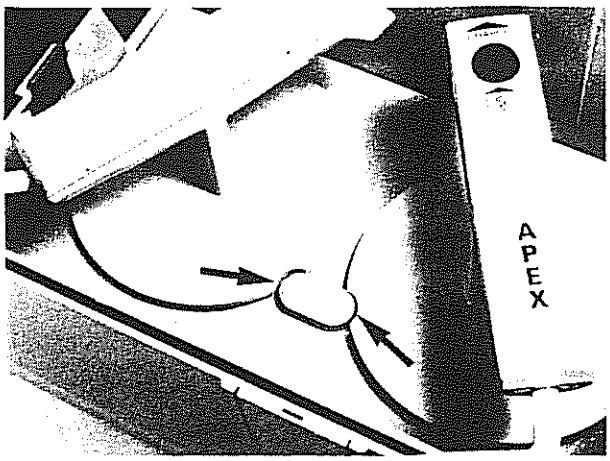

Figure 4

- Set energy selector switch (6) to 350 Joules
- Initiate storage process by pressing red button (3) on APEX electrode: digital display (9) indicates energy to be released into 50 Ω

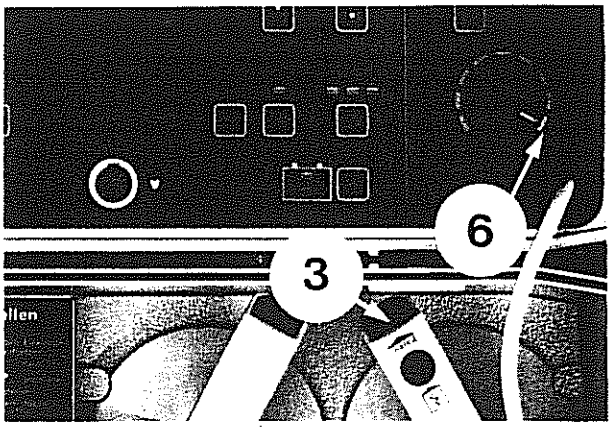

Figure 5

- When storage process is terminated (pilot lamp (7) lights up and buzzer sounds), release current pulse by pressing red buttons (2) and (3) on electrodes within the next 16 s: red pilot lamp goes out and buzzing stops; digital display shows energy released into test resistance of 50 Ω for 4 s (between 340 and 360 Joules)
- Warning: Defibrillator is ready for operation even when cardioscope is switched off, if energy selector switch is not set to 0

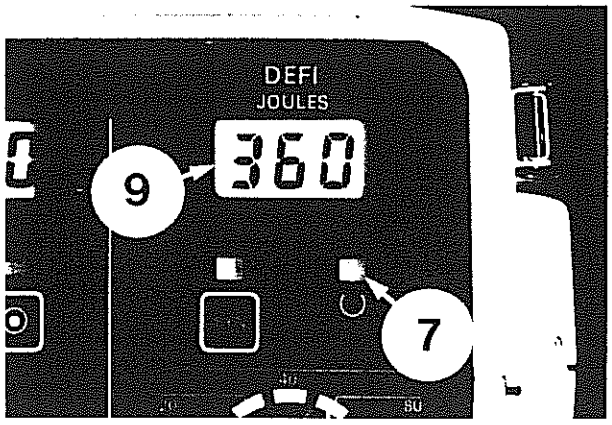

Figure 6

Note:

The performance check as well as the safety discharge may not be carried out more than 5 times in succession to prevent overloading of the discharge circuit. A waiting period of 5 min is required before such testing is repeated.

The instrument should be checked by our service technicians at regular intervals to ensure that the instrument is in good working order and, in particular, that all voltage-conducting parts are properly insulated.

2.3 Important Information

The following points must be observed without fail before defibrillation is initiated:

- The person carrying out the defibrillation should have at least one assistant
- All assistants must be briefed regarding the preparations for and implementation of the defibrillation and be assigned their tasks
- Lay the patient on a surface which is not too soft and make sure that he is electrically **isolated**
  - The patient should not be allowed to come into contact with metal parts, e.g. a bed or litter, to prevent shunts and current paths which endanger the assistants.
- Have a pacemaker at hand, if possible
- Should cardiac arrest occur or be imminent during the preparations for defibrillation, carry out heart massage and administer artificial respiration
- Do not allow the defibrillator electrodes to come into contact with other electrodes or metal parts which are in contact with the patient
- Any instruments, transducers, or other devices which are not defibrillation-proof must be disconnected from the patient (remove patient cable, for example)
- Interrupt heart massage and artificial respiration during pulse release, disconnect tubes, and have assistants step back
- The patient's chest must be dry; moisture causes shunts, combustible skin cleaning agents must be completely dry for reasons of safety
- Oxygenation in the vicinity of the defibrillator electrodes must be prevented; if necessary, interrupt the oxygen supply
- If the patient has an implanted pacemaker, it may well be damaged or functionally impaired by the defibrillation. Therefore, procede as follows:
  - Select the lowest energy level possible for the intended application
  - Do not apply the defibrillator electrodes in the vicinity of the pacemaker, if possible
  - Have an external pacemaker at hand, if at all possible
  - Check the working order of the implanted pacemaker after the defibrillation.

2.4 Electrode Application

- Apply an ample amount of electrode cream to the contact surfaces of the electrodes

  Note: If it is probable that manual cardiac massage will have to be carried out after defibrillation, do not use electrode cream, as it can cause the operator's hands to slip from the patient's chest. In such a case, it is advisable to lay linen cloths soaked in saline solution between the skin and the electrodes.

- Ensure that no conductive paths are created on the patient's chest between the electrode application sites by excessive electrode cream

- Position electrodes in such a way that as much pulse current as possible flows through the myocardium (imaginary line between centers of electrodes should be congruent to axis of heart)

- Apply electrodes without tilting so that entire surfaces contact skin

- Press electrodes firmly onto thorax during pulse delivery

  The electrode handles should always be clean and dry so as not to subject the operator to electrical hazard

  Note: Recent medical literature on emergency resuscitation recommends that the defibrillation pulse be released at the end of the expiratory phase.

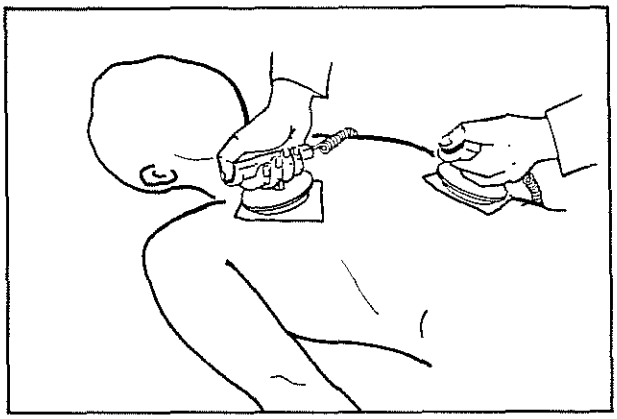

Figure 7

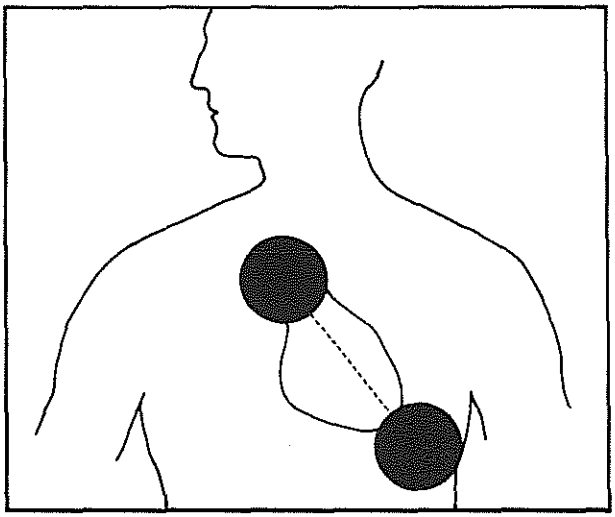

Figure 8

2.5 Nonsynchronized Defibrillation

Emergency Defibrillation

- Prepare patient and electrodes as described in Sections 2.3 and 2.4

- Set energy selector switch (6) to the required defibrillation energy level

The energy level for defibrillation depends on the defibrillation method, the patient's age, and his constitution. The thickness of the tissue is also a factor which influences the amount of energy required for external application.

The amount of energy required for successful ventricular defibrillation without damaging the myocardium has been a matter of scientific controversy for many years. The manufacturer is, therefore, not able to make any recommendations in this regard.

According to IEC recommendations, the energy adjusted on this defibrillator is not the stored energy, but the energy to be released into an external resistance of 50 Ω (patient resistance + electrode-to-skin contact resistance). The ENERGY selector switch is labelled accordingly.

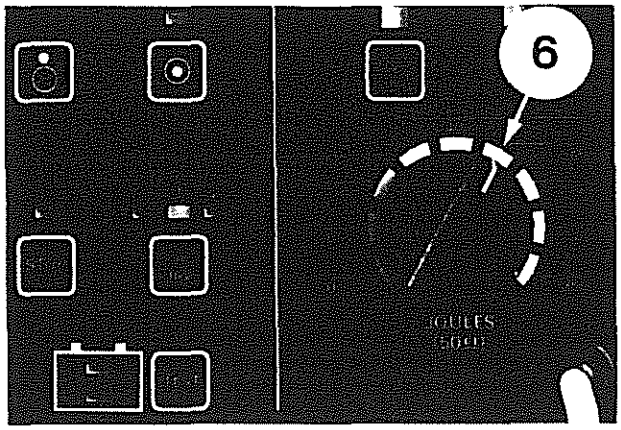

Figure 9

- Apply electrodes to thorax and press them down firmly (Figure 7)
- Do not touch the patient any more and warn everyone present
- Briefly press CHARGE button (3) on APEX electrode: capacitor is charged

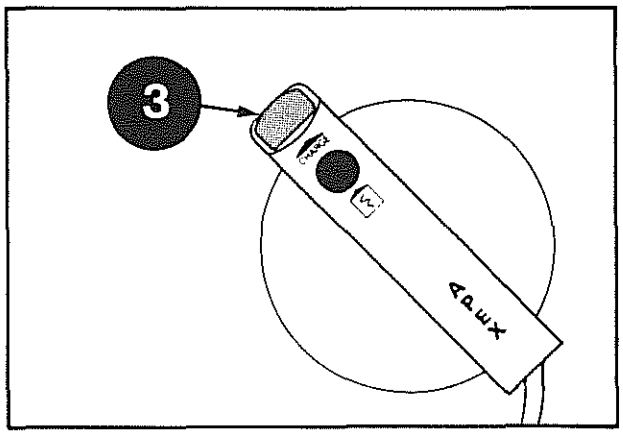

Figure 10

- Display (9) indicates energy to be released into 50 Ω

- When red pilot lamp (7) is illuminated and buzzer sounds, release defibrillation pulse by pressing both pushbuttons within 16 s

The energy actually released into the patient is shown on display (9) for 4 s. If the displayed value is considerably greater than it was before the defibrillation pulse was released, it is probably due to poor electrode-to-skin contact (electrode cream!).

If the current surge is not triggered within a 16-s period after red pilot lamp (7) lights up and the buzzer starts to sound, the storage capacitor in the instrument is discharged internally (safety discharge). If this happens, button (3) on the APEX electrode must be pressed again to store the energy anew. If the pulse circuit is not closed (electrodes not applied, cables or electrodes defective, etc.), the storage capacitor is discharged internally, in this case as well, 125 ms after the defibrillation pulse has been triggered.

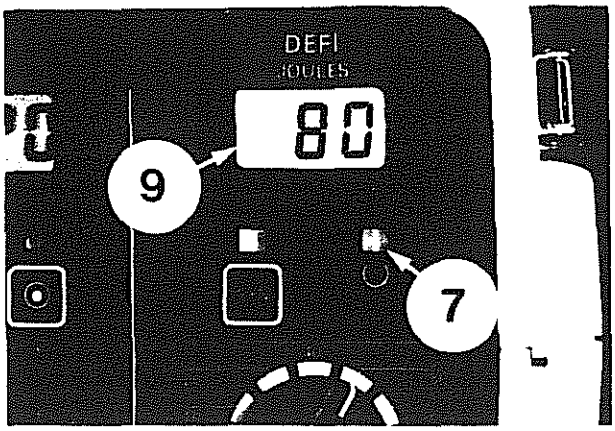

Figure 11

- Once therapy is ended, set energy selector switch (6) to 0, clean electrodes (see Section 2.11), and insert them into the corresponding recesses in the lid (discharge testing device)

Note: If the energy is increased on energy selector switch (6) during the charging process, the storage capacitor is charged to the new level. If, on the other hand, the energy setting is reduced, the capacitor is discharged internally and the CHARGE key must be pressed again.

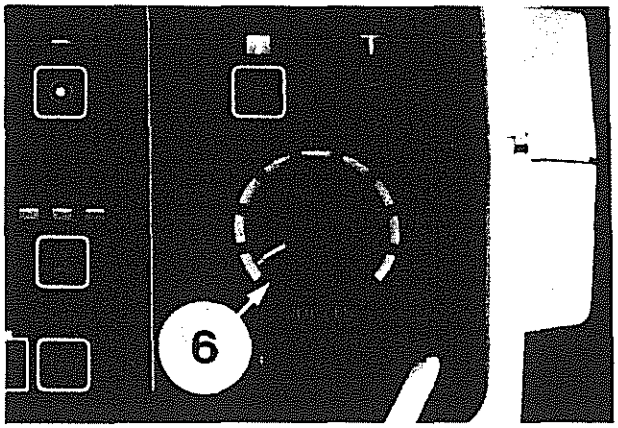

Figure 12

2.6 Cardioversion (Synchronized „Defibrillation")

- Prepare patient and electrodes as described in Sections 2.3 and 2.4
- Set energy selector switch (6) to zero
- Apply ECG electrodes (e.g. for EINTHOVEN limb leads), connect patient cable to electrodes and socket (18)

  For detection of cardiac action potentials, refer to our application note on **Electrocardiography** and other literature on this subject.

Use only silver-chloride electrodes, otherwise excessive polarization could simulate cardiac arrest on scope or recorder.

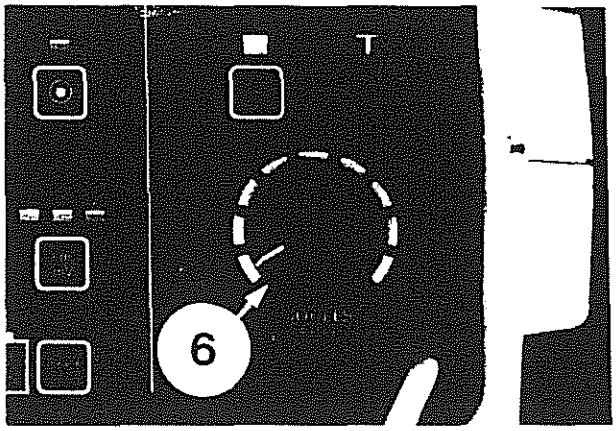

Figure 13

- Press key (14) to switch CARDIOSCOPE on: pilot lamp (14) lights up, ECG is displayed on screen, and heart rate is indicated on digital display (12)

  The dash on the display (13) must be in the limb-lead-symbol position. If it is not, electrodes must be checked for proper electrode application and contact.

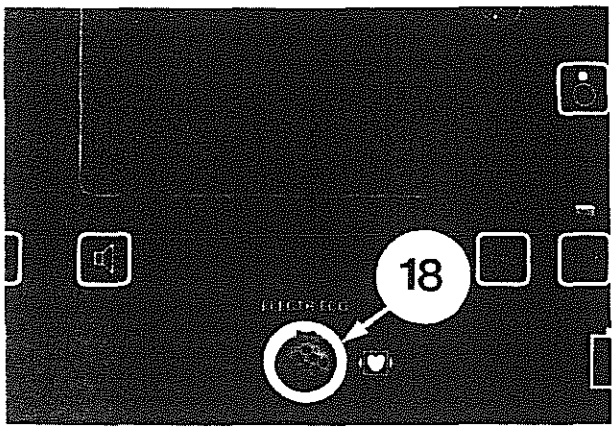

Figure 14

- Press SYN button (8): pilot lamp (8) lights up

  If the pilot lamp does not light up, the defibrillator cannot be switched over to the operating mode "with synchronization". This can be due to one of the following reasons:

  – cardioscope is not switched on
  – patient cable is not connected to socket (18)
  – electrodes are not connected to patient cable
  – electrodes are not applied on patient or are not applied properly.

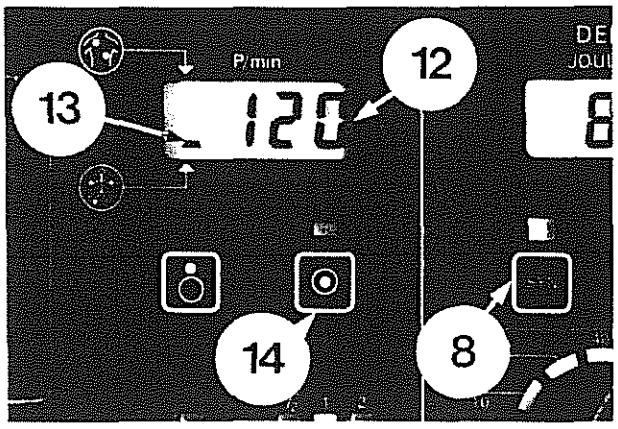

Figure 15

- Set energy selector switch (6) to required defibrillation energy

  The energy required for defibrillation depends on the type of application, on the age, and on the constitution of the patient. The tissue thickness is also a factor for the amount of energy required for external defibrillation.

  The amount of energy which is required for a successful ventricular defibrillation without damaging the myocardium is a matter of scientific controversy. Therefore, the manufacturer is not able to make any recommendations in this regard.

  For this defibrillator, it is not the stored energy, but the energy to be released into an external resistance of 50 Ω (patient resistance + electrode-to-skin transfer resistance) which is adjusted, according to IEC recommendations. The energy selector switch is labelled accordingly.

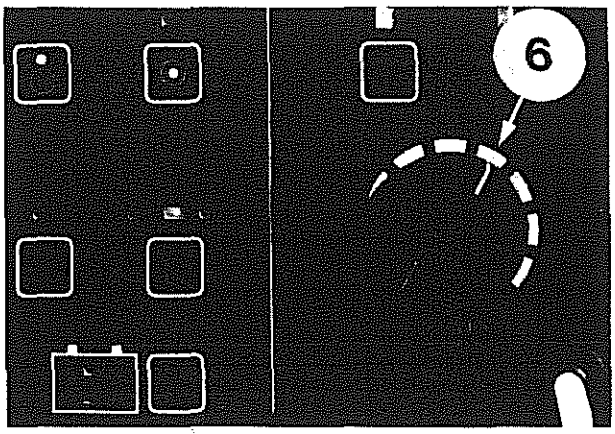

Figure 16

- Apply electrodes to thorax and press firmly (Figure 7)

- Do not touch patient any more and warn all present

- Briefly press button (3) on APEX electrode: energy storage capacitor is charged

- DEFI display (9) indicates energy to be released into 50 Ω

- Press buttons on electrodes within 16 s after pilot lamp (7) lights up and buzzer sounds (energy to be released into 50 Ω on display (9)): next R-wave triggers defibrillation pulse

  The energy actually released into the patient is shown on display (9) for 4 s. If the displayed value is considerably greater than it was before the defibrillation pulse was released, it is probably due to excessive patient impedance (see Section 2.4).

  The instant of triggering is shown on the screen by a dashed-line image of the QRS complex.

  If the current surge is not triggered within a 16-s period after red pilot lamp (7) lights up and the buzzer starts to sound, the storage capacitor in the instrument is discharged internally (safety discharge). If this happens, button (3) on the APEX electrode must be pressed again to store the energy anew. If the pulse circuit is not closed (electrodes not applied, cables or electrodes defective, etc.), the storage capacitor is discharged internally, in this case as well, 125 ms after the defibrillation pulse has been triggered.

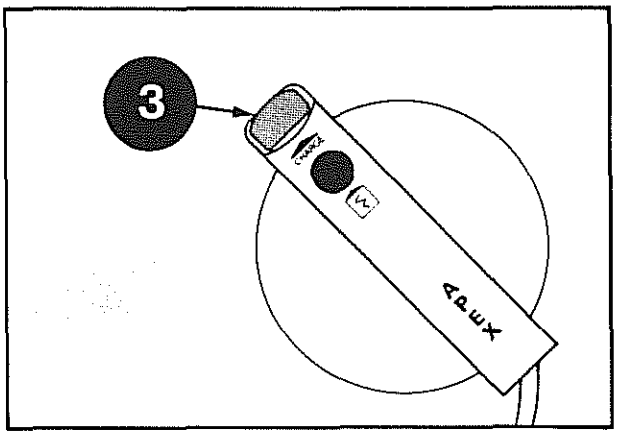

Figure 17

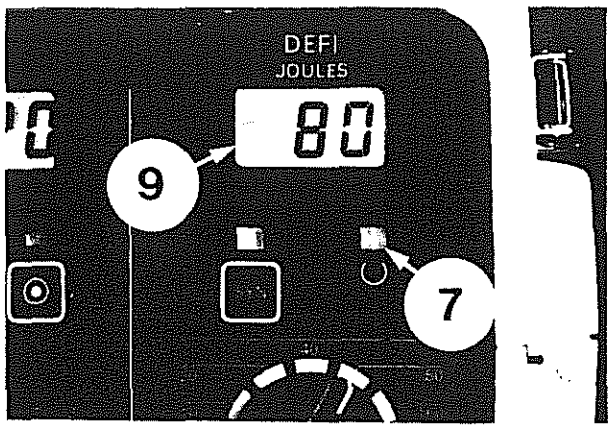

Figure 18

- Once therapy is ended, set energy selector switch (**6**) to 0, clean electrodes (see Section 2.11), and insert them into the corresponding recesses in the lid (discharge testing device)

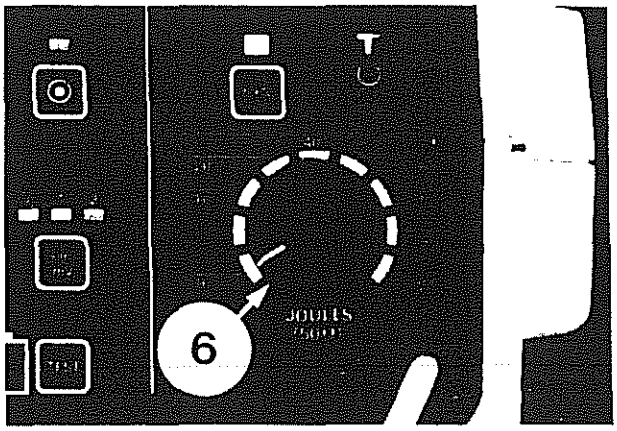

Figure 19

Note: After every synchronized defibrillation, the instrument automatically switches to the "nonsynchronized" mode. Therefore, the SYN mode must be selected anew by pressing key (**8**) before synchronized defibrillation can be carried out. This measure is to prevent pulse blocking for nonsynchronized defibrillation in an emergency.

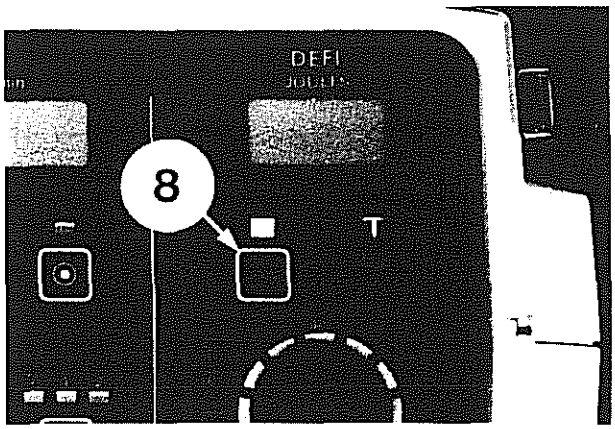

Figure 20

2.7 ECG Display and Recording, Heart-Rate Indication

Cardioscope

For a quick, preliminary diagnosis, the ECG signal can be picked up from the patient's thorax via the defibrillator electrodes. For a more thorough diagnosis and for synchronized defibrillation, the ECG signal must be picked up via limb electrodes. In both cases the cardioscope is operated as follows:

- Switch cardioscope on by pressing key (14)

  Dash (13) indicates by its position whether the ECG signal is being picked up by the defibrillator electrodes or by the ECG electrodes. The dash only indicates the ECG-electrode mode, if the electrodes are properly applied and if the correct cables are used. Pilot lamp (14) flashes every time a systole triggers a pulse release. Simultaneously, a systole tone sounds. If the ECG signal is to be picked up via defibrillator electrodes, make sure that the dash is in the upper-symbol position.

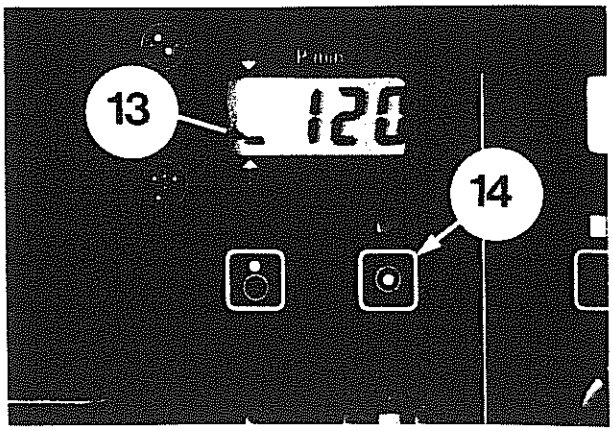

Figure 21

- Switch systole tone on or off, as desired, by pressing key (20)

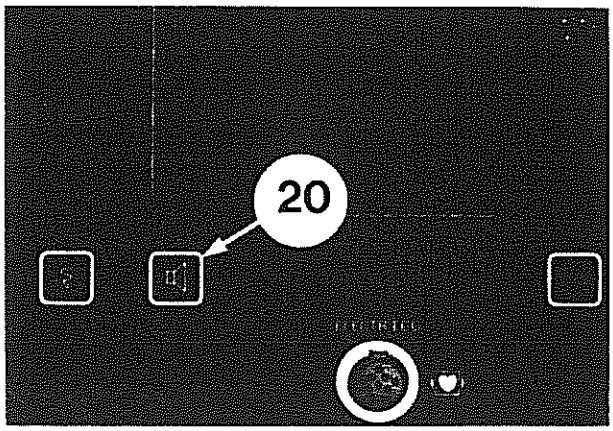

Figure 22

- Select desired amplitude of ECG signal by pressing key (11)

  Whenever the cardioscope is switched on, an amplitude (sensitivity) of 1 cm/mV is automatically selected. The sensitivity can be changed to 1/2,1, or 2 cm/mV by repeatedly pressing key (11). The selected sensitivity is indicated by illumination of the respective pilot lamp.

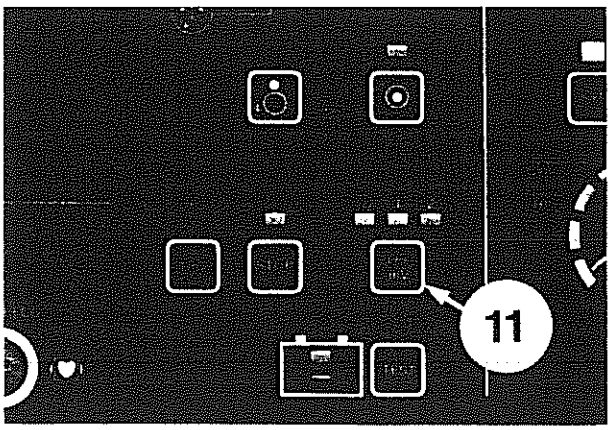

Figure 23

- 1-mV calibration pulses can be superimposed on the ECG display by pressing key (**17**)

  The calibration pulse is stored until the next R-wave occurs. Immediately thereafter, it appears on the screen.

- ECG display can be frozen on screen by pressing STOP key (**16**)

  Pilot lamp (**16**) is lit when ECG display is frozen. The ECG waveform can be released by pressing key (**16**) again.

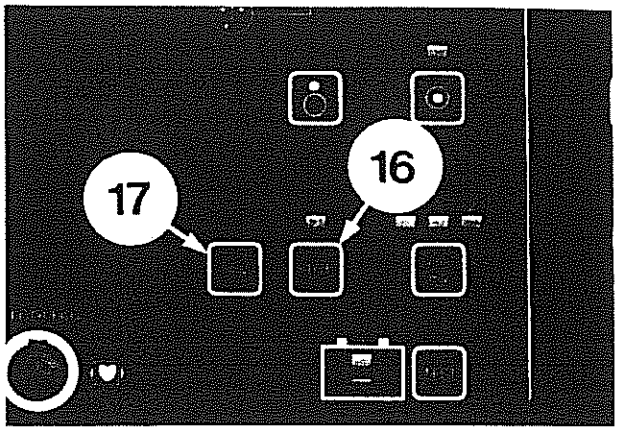

Figure 24

- Heart rate is indicated on display (**12**), if triggering occurs properly

Note:

If there is no ECG signal, the cardioscope is automatically switched off approx. 4 min after the last pulse triggered by an R-wave. If the red state-of-charge battery pilot lamp starts to flash, and if the battery is not charged within the next 3 min, the cardioscope is switched off in this case as well.

If the ECG electrodes are applied properly, and if they are connected to the instrument, the ECG signal is picked up only by these electrodes (and not by the defibrillator electrodes).

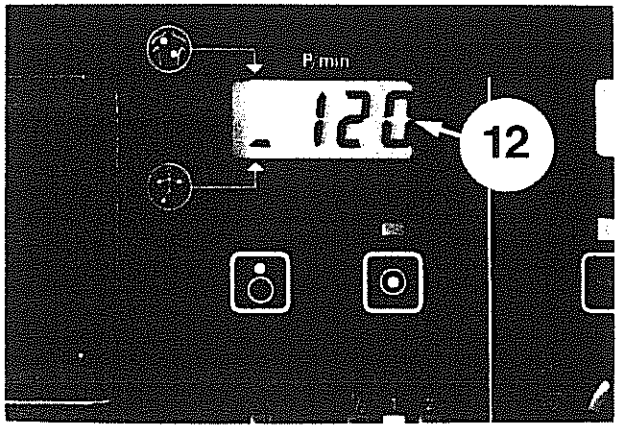

Figure 25

ECG Recording and Printout of Values (only for SCP 852 Version)

To record the ECG and to print out the heart-rate values, the patient and the instrument must be prepared just as for ECG display on the screen.

- Switch cardioscope on by pressing key (**14**)

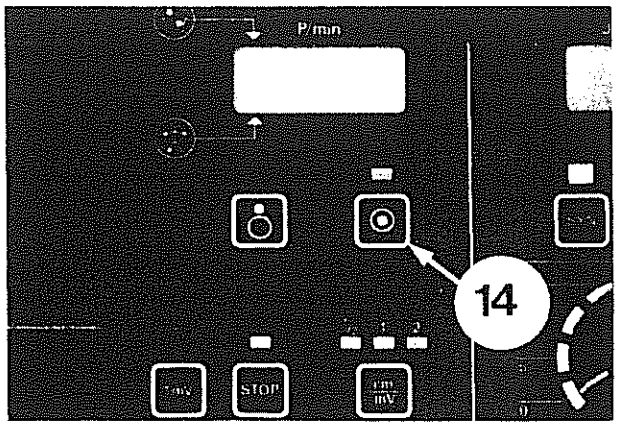

Figure 26

- If ECG is displayed on screen (**19**), recorder is started by pressing key (**21**) or button (**4**) *(on APEX electrode)*

  Every time the recorder is switched on, a 1-mV calibration pulse is automatically recorded immediately after the first R-wave. Subsequent calibration pulses can be superimpsed by pressing key (**17**).

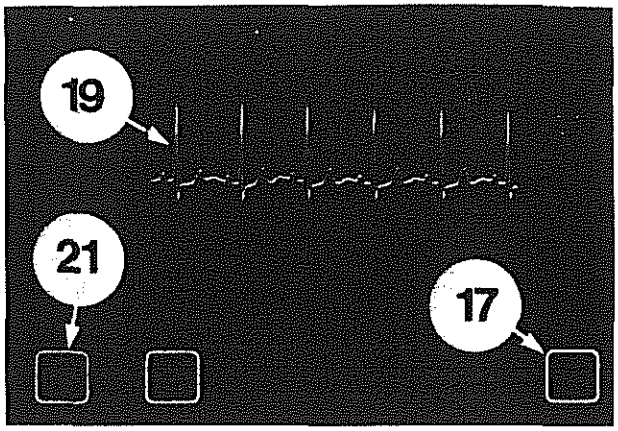

Figure 27

- Following values are automatically printed out at beginning of every recording phase on lower margin of recording strip:

  (a) time in min (starts to run when cardioscope is switched on)

  (b) heart rate in beats/min (P/min)

  (c) energy to be released (indicated in Joules on display (**9**)) upon "ready-for-pulse-release" signal

  (d) actually released current in Ampères (only after defibrillation)

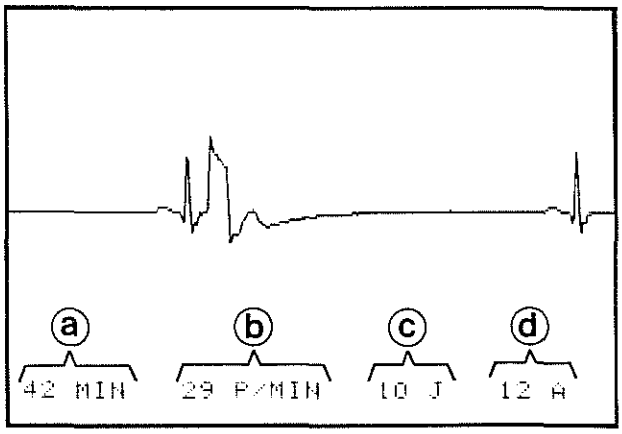

Figure 28

Note:

The recorder is automatically switched off 10 s after it has been started. If, however, a defibrillation is carried out within this period of time, the recorder is automatically switched off 10 s after the defibrillation. The data printout is repeated after every defibrillation.

If the external resistance (patient resistance + electrode-to-skin transfer resistance) is *greater than* 120 Ω, "CREME? " *is printed* on the strip instead of the current value. This is to indicate that the electrode application should be checked (see Section 2.4).

The recorder can be stopped at any time by pressing key (**21**) or button (**4**).

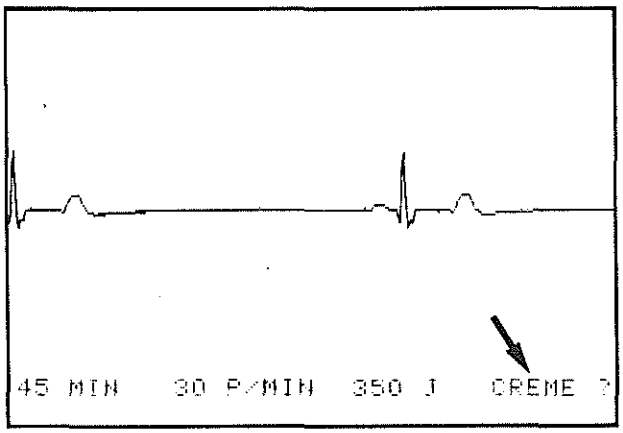

Figure 29

2.8 Chart-Paper Loading *(only on SCP 852 Version)*

- Release writing flap by lifting and pulling on handle tab

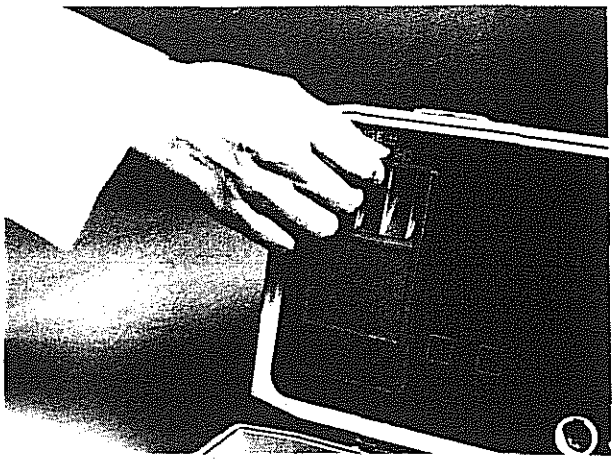

Figure 30

- Open writing flap

Figure 31

- Eject empty cardboard spool from paper compartment by pulling on white plastic strip

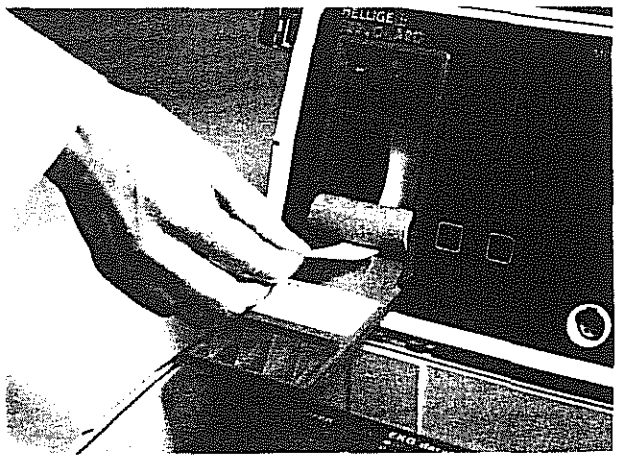

Figure 32

- Insert new paper roll so that blank back side faces up (only use roll paper Cat. No. 226 130 01)

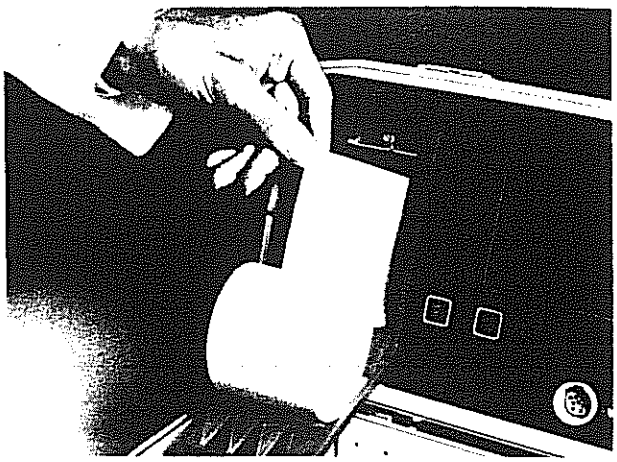

Figure 33

- Switch recorder on by pressing key (**21**) and at same time feed leading end upward behind rubber roller: recorder drive starts to run transporting paper until it appears above rubber roller

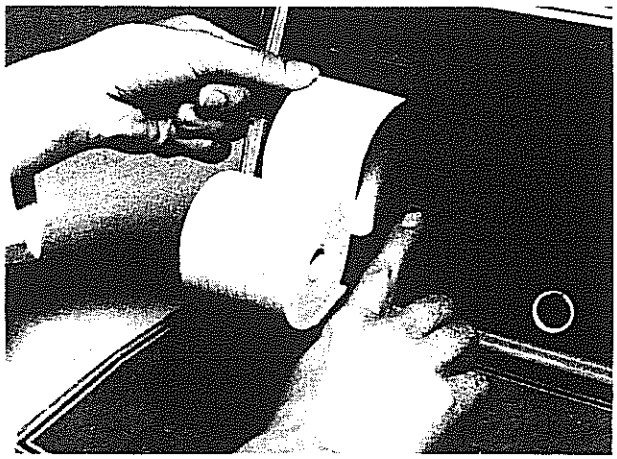

Figure 34

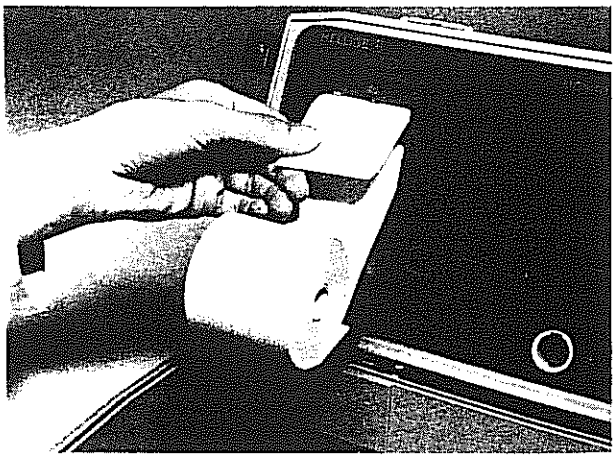

Figure 35

- Thread leading end of paper through slot between run-out surface and Plexiglas angle pieces while lifting writing flap

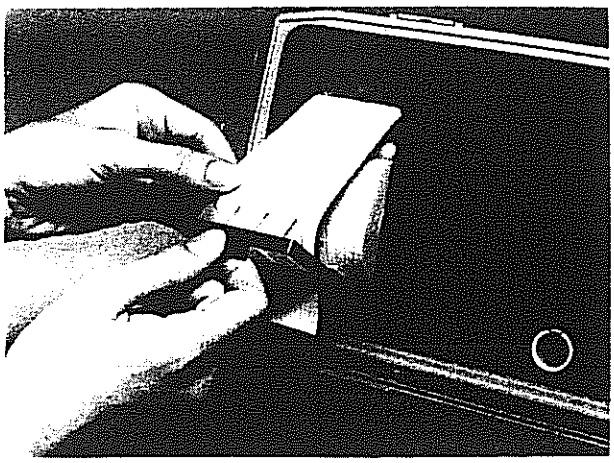

Figure 36

- Close writing flap and straighten paper

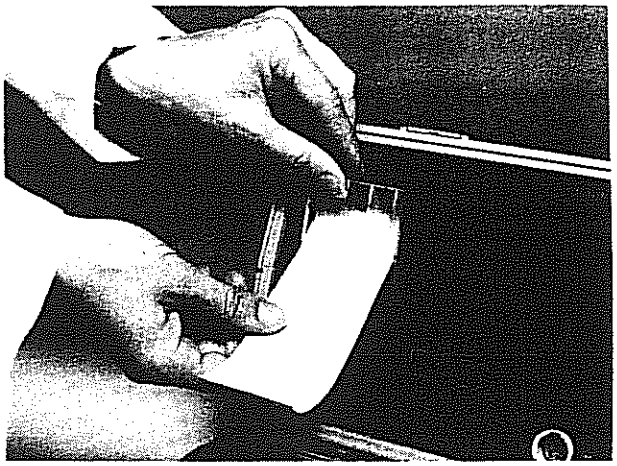

Figure 37

2.9 Troubleshooting

The functions of the defibrillator are automatically tested when it is switched on and continuously during its operation. If the defibrillator detects any defects, it automatically switches itself off. Digital display (**9**) is extinguished.

Defibrillator switches itself off as soon as it is switched on

- Check position of energy selector switch (**6**), correct if necessary, and start again
- Do **not** press release button (**2**) on defibrillator electrode to start storage process; only press CHARGE button (**3**) on APEX electrode
- Check state of charge of battery (see Section 2.2); if necessary, charge battery (see Section 2.10)

Defibrillator switches itself off during storage process

- Check state of charge of battery (see Section 2.2); if necessary, charge battery (see Section 2.10)

If defibrillator cannot be started after these measures have been taken, notify your service office.

2.10 Battery Charging

- Pull power-cord plug from retaining device in recess on side of instrument and extract power cord as far as necessary, but not beyond "STOP" (25 cm from end of cord)

- Plug power-cord plug into line-power wall outlet (voltage must be same as that indicated on nameplate): yellow pilot lamp (**10**) flashes, i.e. quick-charge mode has started

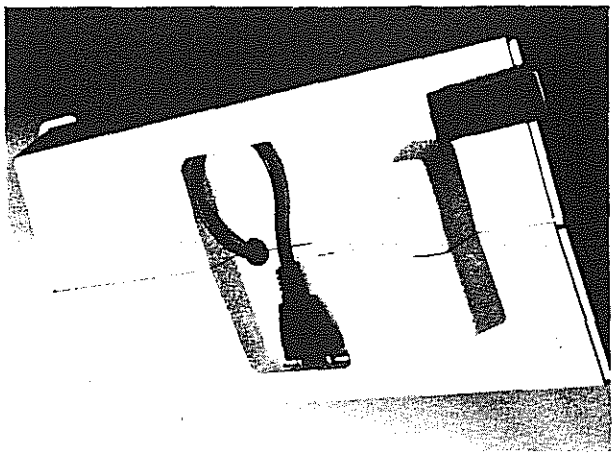

Figure 38

After 2 min the instrument automatically switches over to the conventional charging mode: yellow pilot lamp (**10**) is continually lit.

If the battery was depleted, a quick-charge is sufficient for 3 defibrillations of 350 J each.

Defibrillation can be carried out even while the defibrillator is being charged. However, if defibrillation takes place during the quick-charge process, it could happen that the battery charge is only sufficient for 2 defibrillations at 350 J after a 2-min quick-charge.

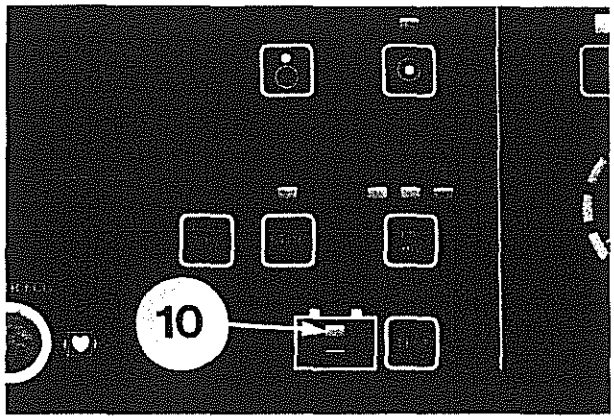

Figure 39

- Pull power-cord plug from wall outlet when charging is terminated and allow power cord to be reeled in automatically by pulling slightly on cord to unlock wind-up device and then guiding cord back into recess to prevent it from being damaged

Note:

We recommend that the instrument be left connected to the power line when it is not being used to ensure that it is always ready for application. The instrument is equipped with a device which prevents the battery from being overcharged.

2.11 Electrode Cleaning and Sterilization, Instrument Care

This instrument is battery-power operated and has no operating element to switch it off. This ensures fast and reliable readiness in emergency situations.

On the other hand, this measure demands special care in manipulating the electrodes. The following points must be observed under all circumstances:

- Set energy selector switch to zero
- Energy display must be blank (check frequently)
- Do not touch charge and release buttons on electrodes

Caution: Display of an energy value greater than 0 and sounding of the buzzer indicate defibrillation readiness and, thus, danger for the operator in the vicinity of the electrode contact surfaces.

The electrodes (not the cables!) may be cleaned with warm water and soap. Cleaning agents, such as those listed below, may also be used. **Do not allow pushbuttons to become wet!**

The contact inserts can be unscrewed by turning them counterclockwise. When removed, they may be sterilized by any conventional means. However, make sure that the electrodes are completely dry before they are reused. Damp electrodes are hazardous for the operator.

The instrument surface may be cleaned and disinfected with commercially available cleaning agents and disinfectants, such as BURATON, CIDEX, INCIDIN GG, and LYSOFORMIN.

Suitable spray disinfectants for the instrument surface are:

BACILLOFORM, BURATON Spray, and FUGATIN Spray.

Observe the instructions for use enclosed with the cleaning agent from the respective manufacturer.

3 Technical Data

Entire Instrument

Power

from built-in NiCd accumulator battery:

- rated voltage of battery 12 V
- rated capacity of battery 1.8 Ah
- operating capacity of a new battery after charging

	ambient temperature			
	0 to 20 °C		20 to 40 °C	
	SCP 851	SCP 852	SCP 851	SCP 852
defibrillation pulses 350 J (50 Ohms)	30	20	40	30
plus				
cardioscope operation	2 h	2 h	2.5 h	2.5 h
plus				
recordings of 10 s each	–	40	–	40

1 defibrillation pulse equals approx. 4 min of cardioscope operation or approx. 40 s of recording

Battery charging from built-in line-power charging device even during operation, instrument in protection class II (according to IEC 601-1 and VDE 0750, Section 1/6.77), overload protection, automatic quick charge:

- Duration of quick charge approx. 2 min, sufficient for 3 defibrillation pulses of 350 J each (into 50 Ω)
- Charging time of discharged battery approx. 16 h; after approx. 6 h charging 50 % of battery capacity reached
- Life of battery 3 to 4 years or 800 to 1000 partial discharges or 180 complete discharges

Rated voltage of 220 V

- Operating range 196 to 242 V AC, 49 to 65 Hz
- Rated current 0.45 A (operating current during quick charge 0.45 A, subsequently approx. 0.09 A)
- Power take-up for rated voltage during quick charge approx. 95 W, subsequently approx. 14 W
- Heat dissipation approx. 50 kJ/h

Rated voltage of 115 V

- Operating range 98 to 121 V AC, 49 to 65 Hz
- Power take-up and heat dissipation as for rated voltage of 220 V

Operational readiness

Defibrillator immediately (ready for defibrillation after charging of capacitor), cardioscope after approx. 5 s (CRT warm-up time)

Operating position

any

Environment

Operation

under the following conditions regarded as normal:

- temperature between 0 and +40 °C
- relative humidity between 30 and 95 %, however no condensation in instrument admissible
- atmospheric pressure between 700 and 1060 mbar

Storage

- temperature between - 30 and + 60 °C

Dimensions

space requirements with closed lid:

- width 444 mm (17.5 in)
- height 170 mm (6.7 in)
- depth 440 mm (17.3 in)

Weight

SCP 851 approx. 13,7 kg (30.1 lb)
SCP 852 approx. 14.5 kg (31.9 lb)

including battery, SCP 852 also including one roll of chart paper

Defibrillator

Operating modes

defibrillation with and without synchronization (cardioversion)

Energy storage

with capacitor, capacitor charging from battery, indication of termination of capacitor charging by light-emitting diode and buzzer:

- charging time of capacitor dependent on selected energy level, for charged battery 3 to 11 s, for partially discharged battery (at least 5 min after 15 discharges at 350 J) typically 12 s (maximum 15 s)

Energy selection

by preselection, digital indication of energy to be released into 50 Ω:

- energy adjustable in steps, energy values as released energy into 50 Ω:

Joules (J)
5
10
20
40
80
160
240
350

- possible deviation from selected energy values within values specified by IEC/VDE

Defibrillation pulse

shape resembling a sinusoidal halfwave with aperiodic decay[1]:

- pulse duration for an external resistance of 50 Ω approx. 4.2 ms, measured from pulse beginn to the intersection of the zero line and the tangent in the inflection point of the trailing pulse edge
- delay of pulse delivery for synchronized operation approx. 20 ms after triggering with R-wave

Discharge circuit

oscillating circuit series-connected with external resistance (patient):

- capacitance 30 µF −5 to + 10 %
- inductivity 45 mH 0 ±10 %
- loss resistance 10.7 Ω ±10 %

Pulse output

isolated, no galvanic connection with other circuit elements or case, open-circuit and short-circuit-proof

- test voltage of isolation 9 kV DC

Safety discharge

discharging via internal load resistance:

- after 16 s, if defibrillation pulse has not been released
- after approx. 0.2 s, when defibrillation pulse released, but discharge circuit interrupted
- immediately, when energy selector switch is set to lower value during or after charging

Testing device

state-of-charge battery test with pilot-lamp indication; discharge of stored energy in internal 50-Ω-load resistance; 3-place digital display of energy released

Synchronization

with ECG signal of either polarity:

- minimum amplitude of ECG signal for certain triggering approx. 0.25 mV at a QRS period of 40 ms

[1] see diagram on page 6

Cardioscope

Signal input

via defibrillation electrodes or separate ECG electrodes; emergency operation via defibrillator electrodes; automatic switching to ECG electrodes, if connected to patient; cardioversion control only via ECG electrodes; differential input, symmetrically referred to N, isolated for floating operation (class CF according to IEC); input circuit without galvanic connection with other circuit elements or case (carrier-frequency method), with high-frequency filter and overvoltage protection:

- impedance in transmission range for differential signals approx. 10 MΩ paralleled by approx. 1.8 nF, for common-mode signals referred to N 2 x approx. 200 MΩ
- operating range for differential signals for analog amplification ±4 mV and ±840 mV for superimposed DC voltage (polarization voltage)
- operating range for differential signals for rate measurement ±10 mV for ECG signal at QRS period of 25 ms and ±840 mV for superimposed DC voltage (polarization voltage)
- *operating range for common-mode signals* referred to N ±3 V, for common-mode signals referred to ±700 V
- quiescent input current with termination 2 x 10 kΩ referred to N $<$10 nA each
- patient leakage current (rms value) under normal condition and in single-fault condition (e.g. patient in contact with line voltage) $<$10 μA
- nondestructive range for connection of detection electrodes referred to N ±50 V, nondestructive range for connection of detection electrode and N-connection referred to case and all circuit elements of the applied part ±700 V, all connections protected against high-voltage pulses of either polarity (e.g. defibrillation, HF surgery)

Signal display

cathode-ray memory scope, 1-channel strip-chart display mode; picture tube implosion-protected, with magnetic deflection: horizontal free-running, time-proportional sweep from right to left with latest information at right margin, vertical deflection by stored analog signal, baseline at middle of screen height

- measuring surface of screen 90 mm (image width) x 70 mm (image height) (12-cm picture tube)
- operating range of vertical signal ±30 mm
- sweep speed 25 mm/s
- storage time for running image 3.6 s, for frozen image unlimited
- picture frequency 61.04 Hz (crystal-controlled)

Signal transmission

signal input → amplification → signal sampling → AD conversion → digital conditioning → DA conversion → screen:

- sensitivity switchable: 1/2 - 1 - 2 cm/mV (1 mV input signal results in 2 cm of recording on recorder and approx. 3 cm of display on scope at maximum adjustment (2 cm/mV)), amplitude limiting at approx. ±2 cm on recorder and *at approx. ±3 cm on scope*
- frequency range (−3-dB limits) 0.5 to 30 Hz (European version) or 0.5 to 40 Hz (American version)
- common-mode rejection for common-mode signals applied at differential input referred to N via $<$5 kΩ effective resistance in one of two leads to differential input $>$60 dB for 45 to 65 Hz
- common-mode rejection for common-mode signals applied at differential input and N referred to case via $<$5 kΩ effective resistance in one of two leads to the differential input $>$ 120 dB for 50 Hz (European version) or for 60 Hz (American version)
- signal sampling rate 123 Hz
- signal resolution for digital processing 512 words *with 8 bits (7 bits for cardioversion)*

Calibration

R-wave triggered delayed application of squarewave pulse into amplifier or nondelayed application of voltage jump, if no ECG signal available:

- calibration voltage 1 mV, referred to signal input
- delay from R-wave to release of squarewave pulse approx. 150 ms (squarewave after T-waves)
- *duration of squarewave approx.* 100 ms

Systole check

indication by yellow pilot lamp and audible signal (can be switched off)

Heart-rate measurement

trigger pulses derived from ECG signal of either polarity with automatic adaptation of trigger threshold, rate averaging, storage of results, 3-place digital display with seven-segment digits (liquid-crystal display in multiplex operation):

- measuring range 15 to 300 beats/min, error limits ± 1 beat/min
- digit height of display 12.7 mm
- display updating every 2 s
- minimum amplitude of ECG signal for certain triggering approx. 0.25 mV at a QRS period of 40 ms

Recorder (only for SCP 852)

Recording

direct writing in rectangular coordinates, thermal method (thermal printhead with electrically controlled heating elements records on thermosensitive paper)

- number of recording channels 1
- effective writing width 50 mm
- amplitude frequeney response (-3-dB limits) 0.5 to 30 Hz
- resolution by thermal printhead (vertically) 3 dots/mm

Protocol

- alphanumeric printout on paper margin:
- time as of protocol start in hours and minutes
- heart rate
- selected energy and peak current of defibrillation pulse
- indication (CREME ?), if patient impedance $>120\ \Omega$
- character height 2.3 mm

Recording chart

roll paper:

- paper width 55 mm
- max. roller diameter 63 mm (50-m roll)

Chart transport

drive with electronically controlled DC motor; transport automatically limited:

- paper speed 25 mm/s ±4 %
- transport duration when released 10 s, automatically extended after defibrillation by 10 s

4 Equipment

101 058 01	Defibrillator SCP 851 with memory scope
101 058 02	Defibrillator SCP 852 with memory scope and recorder

Accessories

227 195 02	Operation manual
229 087 01	Dust cover
226 130 01	Chart paper (roll) (only for SCP 852)
223 234 01	Patient cable (for monitoring)
301 340 00	Button-shaped electrode
501 134 00	Strap for electrode 301 340 00
217 162 06	Triple electrode
217 193 04	Disposable electrode without electrode cream (package of 100 each)
223 253 01	Electrode lead, 3-way, 4-mm connector
223 237 01	Electrode lead, 3-way, press-stud connector and protective resistors
301 357 00	Electrode insert for infants
301 358 00	Electrode insert for children
217 083 05	Package of electrode cream (10 tubes each)

Equipment and Operation Site

Instruments of protection class II can be used in any room irrespective of the safety precautions taken in this room. The same applies to instruments with built-in power sources.

The application of instruments in or at the heart, however, requires further safety precautions since leakage currents from electrical equipment can flow through the heart. Thus, during measurements in or at the heart, currents which can otherwise be safely applied prove to be dangerous.

Such currents cannot be avoided merely by the use of faultless instruments, appropriate installation is also required. Safety precautions in the environment of the patient must be equal to the isolation provided by an isolated F-type patient input, for instance.

Potential Equalization

As an additional measure the enclosure of instruments for measurement in or at the heart can be connected to the potential-equalization system of the room via a separate potential-equalization cable. If the protective earth (ground) connector is interrupted, due to a fault, this potential-equalization cable assumes the protective function of the protective earth (ground) conductor. Without potential equalization and with the protective earth (ground) connector interrupted, the earth leakage current which is permitted to amount to 500 μA may flow through the electrically sensitive patient via the operator.
For the connection of a potential-equalization cable, every instrument in protection class I is equipped with a connector. Potential-equalization cables are available for delivery on request.
Supplementary instruments must also be included in the potential-equalization system, if they are installed in the patient environment (area up to 2.5 m distance from the patient, according to IEC 601-1 [1]).

Interconnection of Instruments

Interconnection of instruments is permitted only when the safety of the patient, the operator, and the environment will not be impaired. If the specifications do not contain any information as to the possibility of interconnection with another instrument, the user is obliged to consult the manufacturer or an expert about the effects on the patient, the operator, and the environment, when two devices are coupled.

For the transmission of alarm signals to the hospital's nurse-call system, for instance, this requirement entails the insertion of an isolation relay (refer to section Equipment).

Operation during HF Surgery

Take special care when the cardiac action potential is picked up during HF surgery. Instruments for peroperative use are therefore supplied with patient cables with built-in protective resistors. These are an effective means for limiting HF currents flowing off via the ECG electrodes. In addition, the active surgical electrode should under all circumstances be applied at least 15 cm away from the next ECG electrode.

The utmost caution is advised when HF surgery is performed on pacemaker patients as the pacemaker may be damaged or its function be impaired. The patient should be continuously monitored.

Operation during Defibrillation

The patient cable mentioned in the previous section can also be useful when defibrillation is required while ECG electrodes are applied to the patient. The protective resistors reduce the amount of current flowing off via the ECG electrodes. Some instruments are equipped with a device protecting their input stages against overvoltages occurring during defibrillation. The patient-cable connections of such instruments are marked as defibrillator-proof by the relevant graphical symbol (see page 1).

If in doubt, it is best to separate the patient cable from the instrument during defibrillation in order to protect the patient and the instrument.

Take special care when defibrillating patients with pacemakers because defibrillation voltages are likely to damage the pacemaker or impair the pacemaker function. Therefore, the following measures are recommended:

- The amount of energy selected for a specific application should be as small as possible.
- The defibrillation electrodes should not be applied near the pacemaker electrodes.
- An external pacemaker should be kept at hand.
- The pacemaker performance should be checked as soon as possible after defibrillation.

2 Environment

The instruments are not designed for operation in hazardous environment. Regulations concerning hazardous environments are, however, not applicable where no flammable anesthetics are present and no flammable liquids are used as skin-cleansing agents and skin disinfectants.

Furthermore, the instruments are of limited applicability in **oxygen-enriched atmospheres.** This atmosphere is considered to exist when the oxygen or laughing-gas content of the room air is above 24 %.

Limited applicability of instruments means that only those parts may be operated in an oxygen-enriched atmosphere which have no sparking components and which do not reach temperatures above 120 °C in normal condition (e.g. electrodes and electrode leads).

Another point in selecting the environment is the fact that electric or magnetic interference fields impede the measurement and recording of action potentials or, in extreme cases, prevent them completely. Therefore, the instruments should not be positioned near X-ray or diathermy equipment, near high-power motors or transformers. The vicinity of electrical cables carrying large currents should also be avoided.

The instruments must be specially protected against humidity, e.g. if they are applied outside the hospital. Always leave air vents unobstructed to ensure free circulation of air for cooling the instruments. Furthermore the instruments are designed for operation under the following climatic conditions which according to IEC 601-1 are regarded as normal, if the corresponding specifications do not read otherwise:

- temperature between + 10 and + 40 °C
- relative humidity between 30 and 75 %
- atmospheric pressure between 700 and 1060 mbar.

Temperature ranges for storage of equipment are given in the operation manuals under *Specifications.* Usually a temperature range from −30 to + 50 °C is permitted.

However, note that instruments for emergency application should be stored in such a way as to enable immediate operation under the conditions mentioned above which are regarded as normal.

3 Connecting Instruments to the Power Line

Before the instrument or the system is connected to the power line, the user must ascertain that the voltage and the frequency indicated on the nameplate correspond to the voltage and frequency of the local power line.

The protective measures of protection class I are only effective if such instruments are connected to wall outlets with earthing (ground) contacts.

Do not use extension cords, especially not those with multiple connectors (stumbling hazard, interruption of protective ground conductor or power supply, loose contact).

Before use, check cables for signs of deterioration. Replace damaged cables and connectors immediately.

4 Exchanging Plug-in Modules

Plug-ins are modules provided with knurled screws which can be exchanged without using any tools. Plug-ins may be exchanged by the user. In order to prevent functional disturbances in the plug-in, the basic unit must be switched off during the exchange. The basic unit may only be switched on again after the knurled screws of the inserted plug-in have been tightened, i.e. all rear connectors have full contact.

5 Checking the Alarm System

The alarm system of monitoring instruments and systems must be checked for proper functioning at regular intervals. Nurse-call systems connected with the monitoring installation must be included in these performance checks. The testing procedures are described in the operation manuals of the individual monitors.

6 Cleaning and Disinfecting

Unplug the power cord before cleaning and disinfecting line-power operated instruments. Furthermore the notes in the operation manuals regarding appropriate cleaning and disinfection methods must be observed to prevent damages. If the cleaning and disinfection instructions do not read otherwise, electromedical equipment and its accessories are not suitable for boiling, steam, or hot-air sterilization.

Markings and caution labels on the instrument are important for its safe and reliable use. Do not remove them.

7 Handling of Chemicals

Chemicals required for the application or maintenance of the instrument must under all circumstances be stored, prepared, and kept at hand in the containers provided by the manufacturer. Failure to observe this instruction may result in severe consequences for the patient.

8 Maintenance

In case of interference please observe the section *Interference Elimination* in the respective application note which will be provided on request. Furthermore, the engineers in the sales-service offices will be pleased to advise the customer and help eliminate the interference.

Safe and reliable operation can only be guaranteed if the instruments are serviced at regular intervals. Instruments can be serviced by the sales-service personnel, possibly within the framework of a maintenance contract. Information on servicing can be obtained from the sales-service offices.

9 Literature

[1] IEC Publication 601-1: Safety of Medical Electrical Equipment (1977).

[2] IEC Publication 513: Basic Aspects of the Safety Philosophy of Electrical Equipment Used in Medical Practice (1976).

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